

INPUT DATA FOR THE COOLING PERFORMANCE EVALUATION ON THE FTTS ACTD

1.0 The contractor shall provide the following data for the evaluation of the Cooling System on the FTTS ACTD if designing a conventional mechanical vehicle.

1.1 A **Cooling System Schematic** including all cooling components, heat generating devices, fluid types (air, water, and oil), and fluid flow directions as arranged in the vehicle: The following components shall be included if applicable but not limited to: Engine, Transmission, Oil/Water Heat Exchangers, Oil Pump, Oil Reservoir, Air/Water Heat Exchanger, Water Pump, and Fan)

1.2 Vehicle operating conditions.

- 1.2.1 Operating Ambient Temperature (deg F):
- 1.2.2 Atmospheric Pressure (in Hg):

1.3 Inlet grille

- 1.3.1 Type:
- 1.3.2 Grille height and width (in):
- 1.3.3 Grille area (sq ft):
- 1.3.4 Pressure drop curve:

Air Velocity (SFPM)	Air Resistance (Inches of water)
_____	_____
_____	_____
_____	_____

1.4 Engine - Type and Make:

- 1.4.1 Maximum Hp and RPM:
- 1.4.2 Engine Heat rejection (Btu/min):
- 1.4.3 Engine Oil Cooler Heat Rejection (Btu/min):
- 1.4.4 Engine Oil Type:
- 1.4.5 Engine Oil Specific Heat (Btu/lb):
- 1.4.6 Engine Oil Density (lb-cu ft):
- 1.4.7 Engine Oil Flow Rate (gpm):
- 1.4.8 Engine Oil Cooler Performance Curve from the manufacturer:

Air Velocity (SFPM)	Heat Transfer (Btu/min/1 deg F (ITD))	Air Resistance (Inches of water)
_____	_____	_____
_____	_____	_____
_____	_____	_____

1.5 Transmission – Type, Make, and Torque Converter:

- 1.5.1 Transmission Heat rejection (Btu/min):
- 1.5.2 Transmission Oil Specific Heat (Btu/lb):
- 1.5.3 Transmission Oil Density (lbm/cu ft):
- 1.5.4 Transmission Oil Flow Rate (gpm):

1.5.5 Transmission Oil Cooler Performance Curve from the manufacturer:

Fluid Velocity	Heat Transfer	Oil Side Pressure Drop
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(gpm)	Btu/min/1 deg F (ITD)	(psi)
_____	_____	_____
_____	_____	_____
_____	_____	_____

1.6 Radiator

1.6.1 Coolant Type and % Water/Coolant Mix:

1.6.2 Coolant Specific Heat (Btu/lb-ft):

1.6.3 Coolant Density (lb-cu ft):

1.6.4 Coolant Flow Rate (gpm):

1.6.5 Radiator core height and width (in):

1.6.6 Radiator core area (sq ft):

1.6.7 Radiator Performance Curve from the manufacturer:

Air Velocity (SFPM)	Heat Transfer (Btu/min/1 deg F (ITD))	Air Resistance (Inches of water)
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

1.7 Fan

1.7.1 Fan Speed Ratio:

1.7.2 Fan Efficiency (%):

1.7.3 Fan Diameter (in):

1.7.4 Fan Performance Curve from Manufacturer:

Air Velocity (CFM)	Static Pressure (Inches of water)
_____	_____
_____	_____
_____	_____
_____	_____

1.8 Temperatures

1.8.1 Coolant into Radiator (deg F) **: _____

1.8.2 Coolant from Radiator (deg F) **: _____

1.8.3 Engine Oil to Cooler (deg F) **: _____

1.8.4 Engine oil from Cooler (deg F) **: _____

1.8.5 Transmission Oil to Cooler (deg F) **: _____

1.8.6 Transmission Oil from Cooler (deg F) **: _____

** This data is obtained by running a 0.6 TE cooling test or predicting what these temperatures will be under actual operating conditions

2.0 The contractor shall provide the following data for the evaluation of the Cooling System on the FTTS ACTD if designing a Hybrid Electric Vehicle.

2.1 A **Thermal Management System Schematic** including all heat generating devices, cooling components, fluid types (air, water, and oil) and flow directions as found in the vehicle: The following components shall be included if applicable but not limited to: Engine, Transmission, Generator, Motors, Inverters, Converters, Batteries, Oil/Water Heat Exchanger, Oil Pump, Oil Inverter, Oil Reservoir, Air/Water Heat Exchanger Assembly (including: water pump, Water Pump Inverter, Fan, Fan Motor, Fan Motor Inverter)

2.2 Vehicle operating conditions.

2.2.1 Operating Ambient Temperature (deg F):

2.2.2 Atmospheric Pressure (in Hg):

2.3 Inlet grille

2.3.1 Type:

2.3.2 Grille height and width (in):

2.3.3 Grille area (sq ft):

2.3.4 Pressure drop curve:	Air Velocity (SFPM)	Air Resistance (Inches of water)
	_____	_____
	_____	_____
	_____	_____

2.4 Provide the maximum heat load in Btu/min of all mechanical and electronic components that contribute more than 5% to the total heat load including if applicable but not limited to the following:

2.4.1 Electric traction motors/controllers (Btu/min):

2.4.2 Converters/Inverters (Btu/min):

2.4.3 Electric energy storage systems, such as batteries, ultra capacitors, and flywheels (Btu/min):

2.4.4 Generators (Btu/min)

2.4.5 Hybrid power units such as spark ignition engines, compression ignition direct injection diesel engines, gas turbines, and fuel cells (Btu/min)

2.4.6 Transmission (Btu/min)

2.5 Provide the following pertinent information on all heat exchangers oil/water-coolant, air/water-coolant, and charge air coolers including but not limited to:

2.5.1 Type and Make of Heat Exchanger

2.5.2 Air, Oil, Water-Coolant specific heat (Btu/lb)

2.5.3 Air, Oil, Water-Coolant density (lbm/cu ft)

2.5.4 Air, Oil, Water-Coolant flow rate (gpm)

2.5.5 Air, Oil, Water-Coolant cooler Performance Curve

Fluid Velocity

Heat Transfer

Oil Side Pressure

(Gpm)

(Btu/min/1 deg F (ITD))

(psi)

2.6 Temperatures

2.6.1 Coolant into Radiator (deg F) **:

2.6.2 Coolant from Radiator (deg F) **:

2.6.3 Engine Oil to Cooler (deg F) **:

2.6.4 Engine oil from Cooler (deg F) **:

2.6.5 Transmission Oil to Cooler (deg F) **:

2.6.6 Transmission Oil from Cooler (deg F) **:

2.6.7 Power Electronic air, oil, coolant to Cooler (deg F) **:

2.6.8 Power Electronic air, oil, coolant from Cooler (deg F) **:

** This data is obtained by running a 0.6 TE cooling test or predicting what these temperatures will be under actual operating conditions.